

We Claim:

1. A dual level load limiting belt retractor comprising:
  - a housing having a rotatable take-up spool connected to a belt for winding the belt onto the take-up spool and paying-out the belt from the take-up spool,
  - a lock for locking the take-up spool against rotation in a pay-out direction,
  - a first torsion bar operatively connected to the housing at one end and to the take-up spool at the other end to provide a high level load limit for resisting paying-out the belt when the take-up spool is locked;
  - a second torsion bar operatively connected to the housing at one end and to the take-up spool at the other end to provide a low level load limit for resisting paying-out the belt when the take-up spool is locked, said low level load limit being less than the high level load limit;
  - a switching mechanism operatively cooperating with said first torsion bar and said second torsion bar to switch from the high level load limit to the low level load limit; and
  - an auxiliary load limit mechanism for resisting paying-out the belt when the take-up spool is locked, the auxiliary load limit mechanism being operative when switching from the high level load limit to the low level load limit to supplement the low level load limit at least during the initial operation of the low level load limit.
2. The dual level load limiting belt retractor as defined in claim 1 wherein the auxiliary load limit mechanism comprises a wire that is attached to the low level torsion bar at one end and that has an undulating portion that is disposed in a fixed sinuous guide.
3. The dual level load limiting belt retractor as defined in claim 1 wherein the auxiliary load limit mechanism comprises a bendable generally C-shaped wire that is attached to the low level torsion bar at one end to move therewith, the bendable generally C-shaped wire having an undulating trailing portion that is disposed in a fixed sinuous guide, the undulating trailing portion being permanently reshaped as the wire is pulled through the fixed guide.

4. The dual level load limiting belt retractor as defined in claim 3 wherein the wire has a circular cross section.

5. The dual level load limiting belt retractor as defined in claim 3 wherein the fixed sinuous guide comprises a plurality of curved passages.

6. The dual level load limiting belt retractor as defined in claim 4 wherein the fixed sinuous guide comprises a plurality of curved passages permanently bending the wire into a generally part circular shape.

7. The dual level load limiting belt retractor as defined in claim 6 wherein the curved passages are formed by a plurality of baffles in conjunction with a plurality of convex anvils that are part of a peripheral wall of a cavity.

8. A dual level load limiting belt retractor comprising:  
a housing having a rotatable take-up spool connected to a belt for winding the belt onto the take-up spool and paying-out the belt from the take-up spool,  
a lock for locking the take-up spool against rotation in a pay-out direction,

a first torsion bar operatively connected to the housing at one end and to the take-up spool at the other end to provide a high level load limit for resisting paying-out the belt when the take-up spool is locked;

a second torsion bar operatively connected to the housing at one end and to the take-up spool at the other end to provide a low level load limit for resisting paying-out the belt when the take-up spool is locked, said low level load limit being less than the high level load limit;

a switching mechanism operatively cooperating with said first torsion bar and said second torsion bar to switch from the high level load limit to the low level load limit; and

an auxiliary load limit mechanism for resisting paying-out the belt when the take-up spool is locked, the auxiliary load limit mechanism having a bendable generally C-shaped wire of circular cross section that is attached to the low level torsion bar at one end via a hub so as to move with the low level torsion bar, the

bendable generally C-shaped wire having an undulating trailing portion that is disposed in a fixed sinuous guide so that the undulating trailing portion is permanently reshaped as the wire is pulled through the fixed sinuous guide when switching from the high level load limit to the low level load limit to supplement the low level load limit during an initial operation of the low level load limit,

the fixed sinuous guide including a plurality of curved passages that are formed by a plurality of baffles in conjunction with a plurality of convex anvils that are part of a peripheral wall of a cavity,

the curved passages permanently deforming the wire into a generally part circular shape as the wire is pulled through the curved passages, and

the baffles being spaced from hub to provide space for the wire after it is deformed into the generally part circular shape.

9. A dual level load limiting belt retractor comprising:

a housing having a rotatable take-up spool connected to a belt for winding the belt onto the take-up spool and paying-out the belt from the take-up spool,

a lock for locking the take-up spool against rotation in a pay-out direction,

first means to provide a high level load limit for resisting paying-out the belt when the take-up spool is locked;

second means to provide a low level load limit for resisting paying-out the belt when the take-up spool is locked, said low level load limit being less than the high level load limit;

a switching mechanism operatively cooperating with said first means and said second means to switch from the high level load limit to the low level load limit; and

an auxiliary load limit mechanism for resisting paying-out the belt when the take-up spool is locked, the auxiliary load limit mechanism being operative when switching from the high level load limit to the low level load limit to supplement the low level load limit during the initial operation of the low level load limit.

10. The dual lever load limiting belt retractor as defined in claim 9 wherei the auxiliary load limit mechanism comprises a bendable generally C-shaped wire that is

attached to the low level torsion bar at one end to move therewith, the bendable generally C-shaped wire having an undulating trailing portion that is disposed in a fixed sinuous guide, the undulating trailing portion being permanently reshaped as the wire is pulled through the fixed guide.

11. The dual level load limiting belt retractor as defined in claim 10 wherein the wire has a circular cross section.

12. The dual level load limiting belt retractor as defined in claim 10 wherein the fixed sinuous guide comprises a plurality of curved passages that are formed by a plurality of baffles in conjunction with a plurality of convex anvils that are part of a peripheral wall of a cavity which permanently bend the wire into a generally part circular shape when the wire is pulled through the fixed sinuous guide.